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Indian Standard

PROCESS MEASUREMENT CONTROL FUNCTIONS AND INSTRUMENTATION — SYMBOLIC REPRESENTATION

PART 1 BASIC REQUIREMENTS

भारतीय मानक

प्रक्रम मापन नियन्त्रण कार्य तथा माप यन्त्र — प्रतीकात्मक प्रस्तुति

भाग 1 आधारभूत आपेक्षाएँ

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NEW DELHI 110002

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Indian Standard

PROCESS MEASUREMENT CONTROL FUNCTIONS AND INSTRUMENTATION – SYMBOLIC REPRESENTATION

PART 1 BASIC REQUIREMENTS

NATIONAL FOREWORD

This Indian Standard (Part 1), which is identical with ISO 3511/1 : 1977 'Process measurement control functions and instrumentation — Symbolic representation — Part 1: Basic requirements' issued by the International Organization for Standardization (ISO), was adopted by the Bureau of Indian Standards on 18 August 1989 on the recommendation of the Chemical Engineering Sectional Committee (HMD 17/EDC 57) and approval of the Heavy Mechanical Engineering Division Council.

Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

CROSS REFERENCE

International Standard	*Indian Standard*	*Degree of Correspondence*
ISO 128 : 1982 (ISO/R 128) Technical drawings — General principles of presentation	IS 10714 : 1983 General principles of presentation on technical drawings	Identical

ALTERATIONS

In this national standard only the preferred symbols mentioned under clause **5.1** are applicable. Similarly, in clauses **5.1.3** and **5.1.4**, only the symbols having a stroke repeated along its lengths are applicable.

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0 INTRODUCTION

This International Standard has been devised to provide a universal means of communication between the various interests involved in the design, manufacture, installation and operation of measurement and control equipment used in the process industries.

Requirements within the industries vary considerably, and in recognition of this, this International Standard is presented in three parts as follows :

Part I : Basic requirements (directed towards the needs of those whose prime interest is in basic measurement and control means).

Part II : Extension of basic requirements.

Part III : Detailed symbols.

The three parts together are intended

a) to meet the requirements of those who, possibly employing more sophisticated measurement and control means, may wish to depict such aspects as the measurement techniques embodied in a particular instrument, or the means – hydraulic, pneumatic, electrical, mechanical – used for its actuation;

b) to provide standard symbolic representation for process measurement control functions and instrumentation. These symbols are not intended to replace graphic symbols for electrical equipment as contained in IEC Publication 117.

1 SCOPE AND FIELD OF APPLICATION

Part I of this International Standard establishes a symbols system for use in depicting the basic functions of measurement and control equipment in relation to the plant with which it is associated. The system has been intentionally limited to the identification of instrument functions and does not provide means of illustrating specific instruments.

2 DEFINITIONS

The following definitions are used solely for the purpose of this International Standard to assist in the application and understanding of the symbol system.

2.1 point of measurement : The point in a process at which a measurement is or may be made.

2.2 instrument : A device or combination of devices used directly or indirectly to measure, display and/or control a variable. This term does not apply to internal components of the instruments, for example resistor or receiver bellows.

2.3 panel-mounted instrument : An instrument that is mounted in a group normally accessible to the operator.

2.4 locally mounted instrument : An instrument that is not panel mounted.

2.5 correcting unit : The unit comprising those elements (actuating and correcting) which adjust the correcting conditions, in response to a signal from the controller.

2.6 actuating element : That part of the correcting unit which adjusts the correcting element, for example a response to a signal from the controller.

2.7 correcting element : That part of the correcting unit which directly adjusts the value of the correcting conditions.

2.8 alarm : A device which is intended to attract attention to a defined abnormal condition by means of a discrete audible and/or visible signal, but which does not itself institute corrective action.

2.9 set value : The value of the controlled condition to which the controller is set.

3 SIZE AND OUTLINE OF BASIC SYMBOLS

The symbol requirements given below have been adopted to provide for legibility and ease of drawing. If diagrams are to be photographically reduced, then these sizes should be correspondingly larger.

3.1 Point of measurement

The symbol is a thin line connected to a flow line or to a plant equipment outline. If not connected to an instrument symbol, an identifying letter shall be placed close to this to designate the measurable property. The letters used shall comply with the table.

The location of the symbol shall be functionally correct and placed in the correct process sequence but need not illustrate the geographical position.

However, where it is desirable, for clarification, to identify the location of the point of measurement within a plant equipment outline, a small circle of approximately 2 mm diameter may be used at this point at the end of the thin line as shown in the figures in 6.1.7 and 6.9.

3.2 Instrument

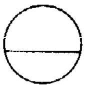
The symbol comprises :

- a thin line circle of approximately 10 mm diameter;
- a letter code showing the property measured and function (see clause 4).

A number may be included to facilitate identification. Where the letter code/identification number cannot be accommodated within the circle, the circle may be broken.

3.3 Panel-mounted instrument

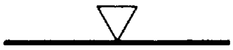
The symbol is a thin line circle of approximately 10 mm diameter with a horizontal thin line across it. The line may be located at any height within the circle.



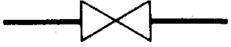
NOTE – For an instrument mounted inside a control panel, the above symbol may include a second horizontal line.

3.4 Correcting element

The symbol for a correcting element of unspecified type is an equilateral triangle with sides of approximately 5 mm length.



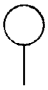
When the type of correcting element is known, established symbols depicting particular correcting elements may be used, for example for a valve :



3.5 Actuating element

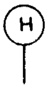
3.5.1 *Automatic actuating element*

The basic symbol is a thin line circle of approximately 5 mm diameter, with a thin line to connect it to the correcting element symbol.



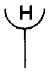
3.5.2 *Automatic actuating element with integral manual actuating element*

The letter H shall be inserted in the circle if there is a manual as well as an automatic facility for positioning the correcting unit.



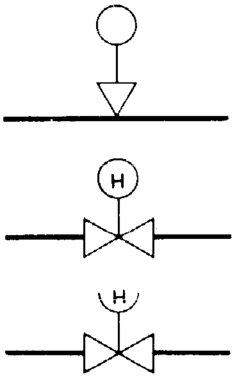
3.5.3 *Manual actuating element*

Where there is only a manual facility for positioning the correcting unit, the symbol consists of a semi-circle of approximately 5 mm diameter beneath a letter H, with a thin line to connect it to the corrrecting element.



3.6 Correcting unit

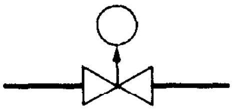
The symbol is the combination of the symbols for the actuator and the correcting element, for example :



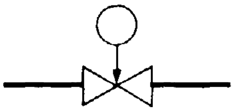
3.7 Actuating element operation

Response of the actuator to failure of the actuating energy may be indicated by an additional symbol, illustrated here for the particular example of a control valve.

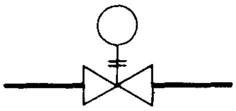
– Control valve opens on failure of actuating energy :



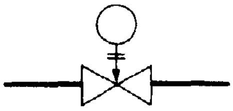
– Control valve closes on failure of actuating energy :

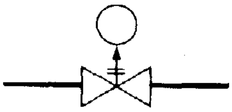


– Control valve retains position on failure of actuating energy :



– A combination of the above symbols could be used to indicate the safe and permitted direction of drift :





4 LETTER CODE

4.1 Identifying letters

The purpose of the instrument shall be defined by a letter code contained within the instrument symbol circle; this letter code shall be constructed on the following basis :

4.1.1 The first letter shall denote the measured or initiating variable, and shall be in accordance with column 2 of the table, but should be modified, if necessary, by the addition of a letter in accordance with column 3.

4.1.2 Succeeding letters shall be in accordance with column 4 of the table.

4.1.3 Where there are two or more succeeding letters, they shall be placed one after the other, in the sequence I R C T Q S Z A. (This does not apply to the letters corresponding to the modifiers in column 3 of the table.) The letter I may be omitted in the case of a self indicating recorder.

4.1.4 For the use of the letter H to denote HAND (manual) operation, see 3.5.

4.2 Qualifying letters

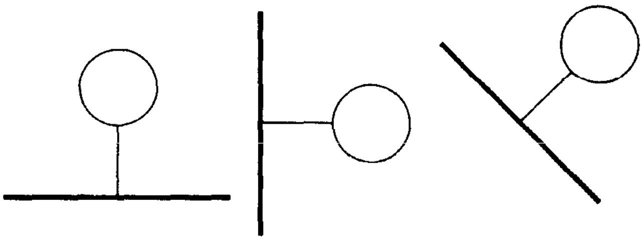
Where it is required to denote HIGH or LOW, the qualifying letters H or L may be used in association with the instrument symbol (see 6.1.5 and 6.1.8).

5 TYPES OF LINE AND ASSEMBLY OF SYMBOLS

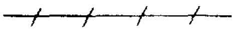
5.1 Types of line (see also ISO/R 128, *Engineering drawing – Principles of presentation*[1].)

The types of lines used in the symbol system shall be as follows, it being conventional for a continuous thick line to represent the flow line of a process or the outline of a plant vessel, etc.

5.1.1 The symbol for an instrument connection to a process is a continuous thin line, thinner than the lines used to delineate the plant.

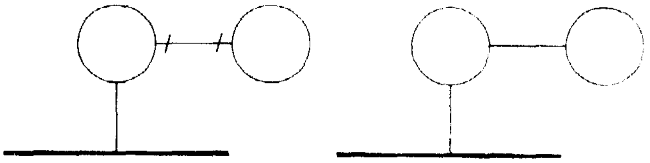


5.1.2 The preferred general symbol for an instrument signal line is a continuous thin line, having a stroke repeated along its length. These strokes are inclined at approximately 60° to the line.



Alternatively, a continuous thin line without strokes may be used where there is no risk of confusion.

Instrument signal lines shall be drawn thinner than process lines.



NOTE – No attempt is made in this part of this International Standard to distinguish between types of instrument actuation (for example electrical, pneumatic and hydraulic), such a distinction being unnecessary for an understanding of the function of the instrumentation.

---

[1] At present under revision.

TABLE – **Letter code for identification of instrument functions**

1	2	3	4
	First letter 1)		**Succeeding letter 1)**
	Measured or initiating variable	**Modifier**	**Display or output function**
A			Alarm
B			
C			Controlling
D	Density	Difference	
E	All electrical variables 2)		
F	Flow rate	Ratio	
G	Gauging, position or length		
H	Hand (manually initiated) operated		
I			Indicating
J		Scan	
K	Time or time programme		
L	Level		
M	Moisture or humidity		
N	Users' choice 3)		
O	Users' choice 3)		
P	Pressure or vacuum		
Q	Quality 2) For example Analysis, Concentration, Conductivity	Integrate or totalize	Integrating or summating
R	Nuclear radiation		Recording
S	Speed or frequency		Switching
T	Temperature		Transmitting
U	Multivariable 4)		
V	Viscosity		
W	Weight or force		
X	Unclassified variables 3)		
Y	Users' choice 3)		
Z			Emergency or safety acting

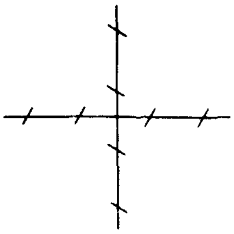
1) Upper case letters shall be used for the measured or initiating variable and succeeding letters for display or output function. Upper case letters are preferred for modifiers, but lower case letters may be used if this facilitates understanding.

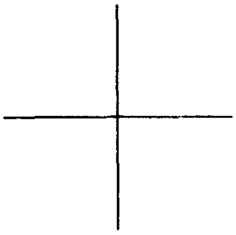
2) A note shall be added to specify the property measured.

3) Where a user has a requirement for measured or initiating variables to which letters have not been allocated and which are required for repetitive use on a particular contract, the letters allocated to Users' Choice may be used provided that they are identified or defined for a particular measured or initiating variable and reserved for that variable. Where a user has a requirement for a measured or initiating variable that may be used either once or to a limited extent, the letter X may be used provided that it is suitably identified or defined.

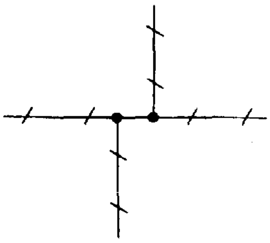
4) The letter U may be used instead of a series of first letters where a multiplicity of inputs representing dissimilar variables feed into a single unit.

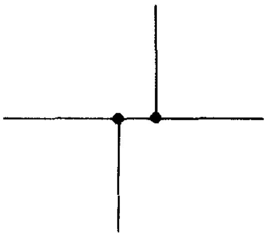
5.1.3 Crossings shall be shown thus :





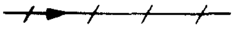
and junctions thus :

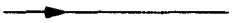




The diameter of the connecting dot shall be approximately five times the width of the associated lines.

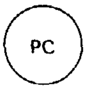
5.1.4 Where it is necessary in illustrating complex systems to indicate the direction in which information is flowing, arrows shall be added thus :

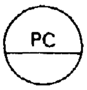




5.2 Position of function-identifying letters

These shall always be placed inside the circle and, in the case of panel-mounted instruments, normally above the horizontal line (except as provided in 5.4). They shall be arranged in accordance with the requirements of 4.1.





5.3 Position of identifying number

If required, the identifying number may be shown either inside the circle or outside the circle and adjacent to it.

When shown inside the circle, the number shall normally be below the identifying letters and, in the case of panel-mounted instruments, below the horizontal line (except as provided in 5.4).

5.4 Alternative arrangement

An alternative arrangement of identifying letters and numbers within the circle may be used provided that the measured or initiating variable letter is placed at the left side of the upper part of the circle.

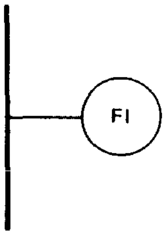
5.5 Position of qualifying letters

Qualifying letters, when used, may be placed inside the symbol circle, or outside the symbol circle and adjacent to it.

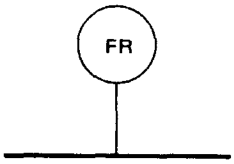
6 EXAMPLES OF USE OF THE SYMBOLS

6.1 Indicating, recording and alarm instruments

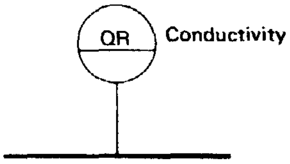
6.1.1 Flow rate indicator – locally mounted.



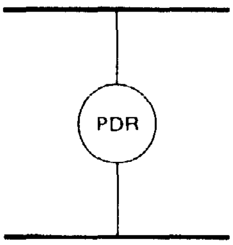
6.1.2 Flow rate recorder – locally mounted.



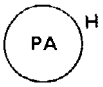
6.1.3 Conductivity recorder – panel mounted.



6.1.4 Pressure differential recorder – locally mounted.

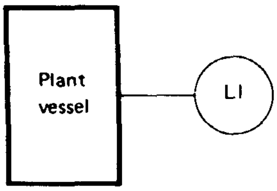


6.1.5 High pressure alarm – locally mounted.

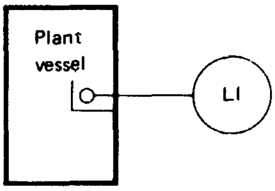


6.1.6 Level indicator – locally mounted.

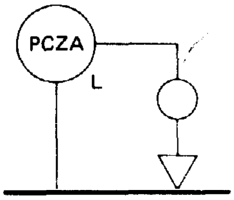
NOTE – The symbol illustrates that the level in the particular vessel is indicated. No inference is to be drawn as to the nature or position of any physical connections to the vessel.



6.1.7 Level indicator – locally mounted – point of measurement inside vessel.

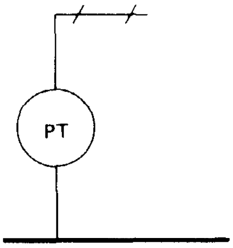


6.1.8 Local low pressure alarm with simultaneous emergency action of correcting unit.



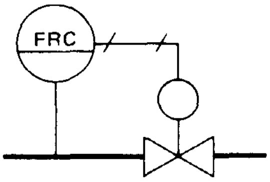
6.2 Blind transmitters (neither indicating nor recording)

This symbol should only be used where there would otherwise be ambiguity as to the nature of the property transmitted. (See also examples under 6.7.)



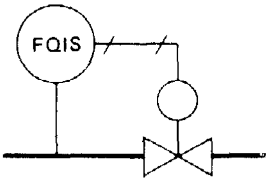
6.3 Automatic controllers

Flow rate recording controller adjusting valve. Instrument panel mounted.

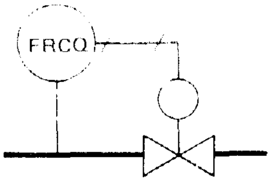


6.4 Integrating instruments

Indication and control of quantity transfer, for example a rotary water-meter with shut-off device. This does not control the rate.

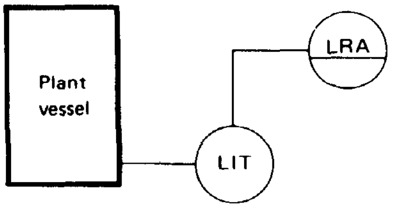


Record and control of flow-rate with summation of volume.



6.5 Multiple display

Where it is necessary to show that a measured value is to be displayed in more than one place, the instrument symbol at the point of measurement may be supplemented by further appropriate symbols, these being connected to the symbol at the point of measurement by thin lines.

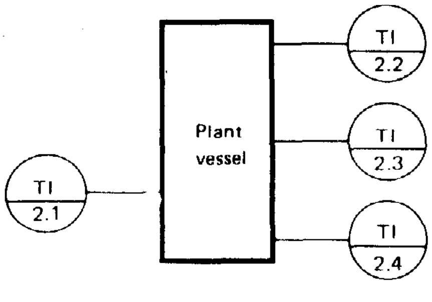


In the more general case where it is important to show multiple measurement and control functions explicitly, these may be represented by individual instrument and correcting unit symbols with appropriate connections by thin lines. Examples of this procedure appear under 6.7, 6.8, 6.9 and 6.10.

6.6 Multipoint instruments

Where a multipoint instrument is to measure the same physical property at a number of points, the appropriate instrument symbol shall be shown at each point of measurement.

NOTE – A numbering system is necessary to relate each point of measurement to the particular multipoint instrument. That shown in the following example should not be regarded as internationally recommended, but has been included to indicate one possible method of numbering.

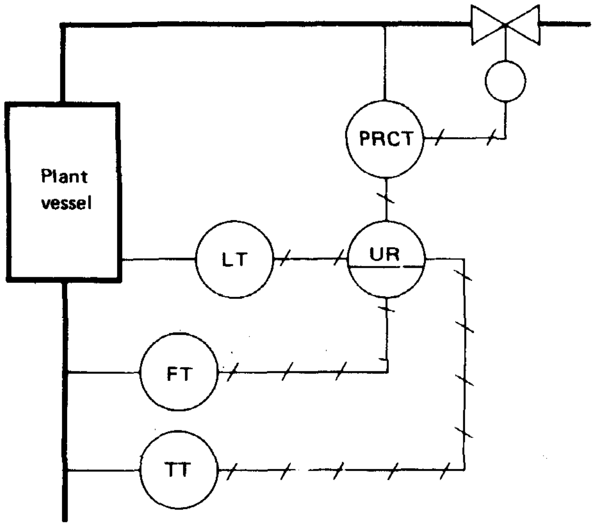


6.7 Multivariable data

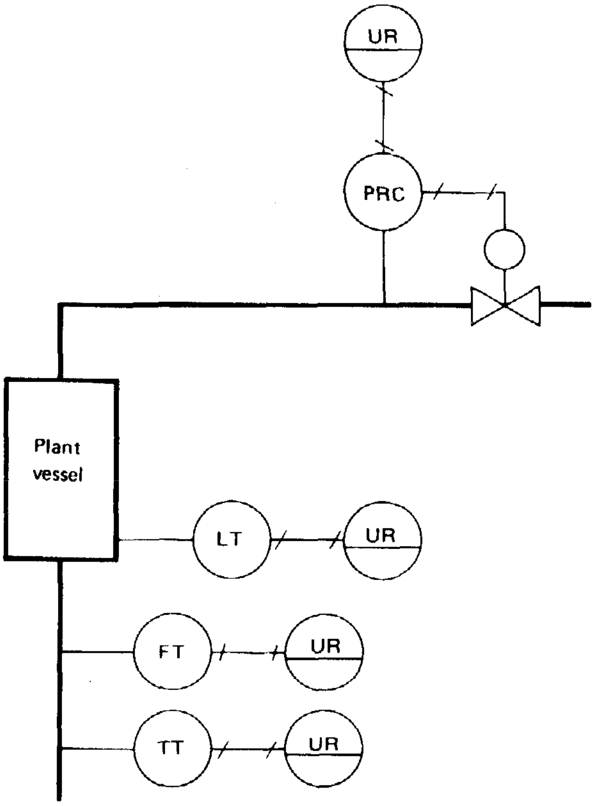
6.7.1 *General*

Where a single instrument, for example a 3-pen recorder or a data logger, is to measure a number of different physical properties, it can be included in the diagram in one of two ways.

For a simple system the symbol may be connected to all individual instrument or measurement symbols.

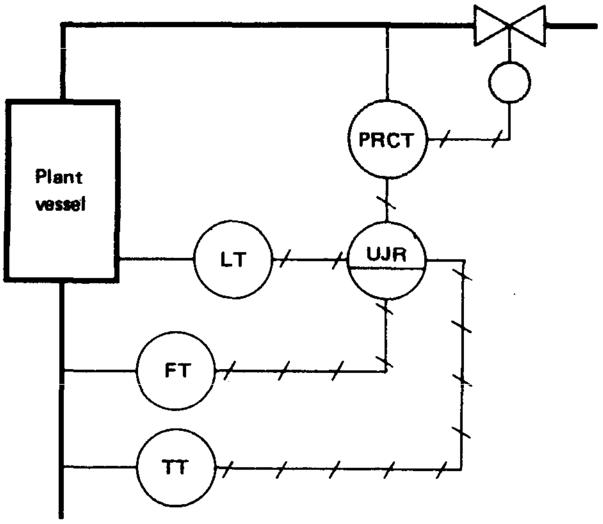


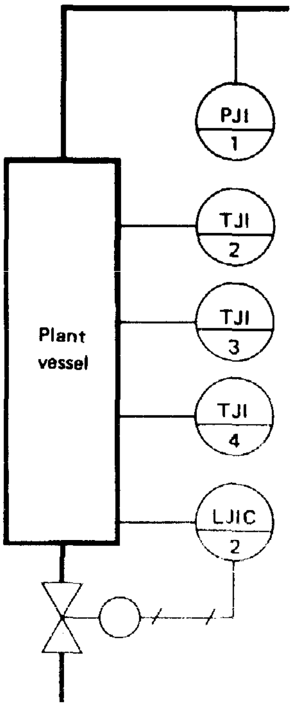
In a more complicated installation or one which does not lend itself to such a layout, the symbol for the multivariable data receiving device may be repeated at each associated instrument symbol, being connected to the usual symbol by a thin line. With this type of presentation, explanatory notes, which may or may not be on the flow sheet, are essential; for example, PRC in the following diagram denotes an instrument which does not have a transmitting function.



6.7.2 *Automatic scanning*

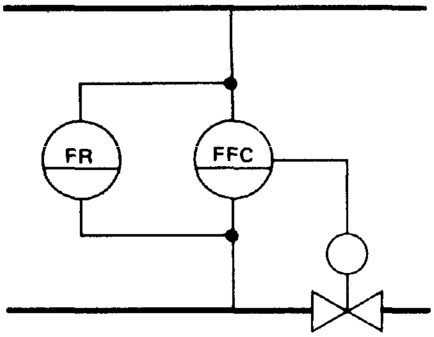
Where the data logger has automatic scanning facilities, this shall be shown as follows :





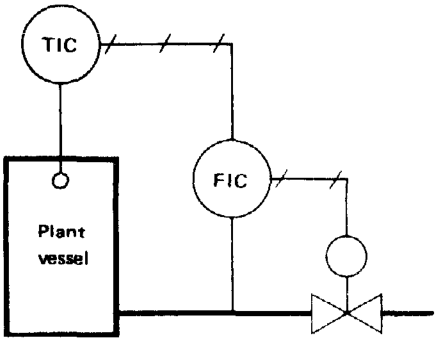
6.8 Ratio control instruments

A controller holding a constant ratio between two flow rates both recorded.



6.9 Cascade control

Where one controller provides the command signal to one or more other controllers, the instrument symbols shall be connected by a thin line.

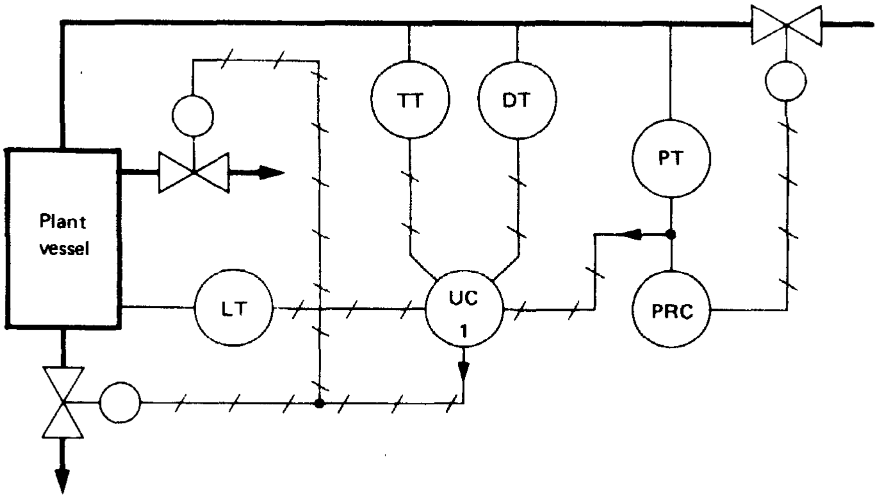


6.10 Multivariable control systems

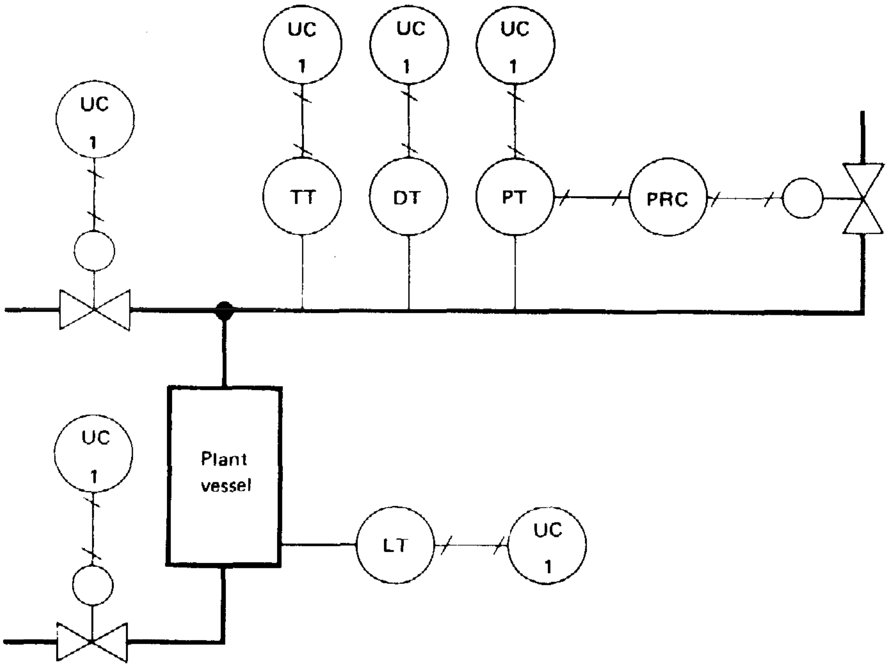
Where a combining device symbolized, for example, by UC UIC URC, receives signals from two or more instruments and selects from these or combines them to operate one or more correcting units, the assembly of the symbols may be arranged in one of two ways.

NOTE – In complex systems, explanatory notes on the flow sheet are usually necessary.

For a simple installation the combining device symbol may be connected by a thin line to other instrument symbols.

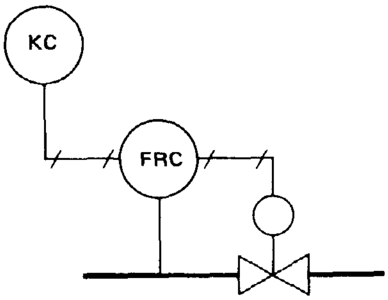


In a more complicated installation or one which does not lend itself to such a layout, the symbol for the combining controller may be repeated at each instrument and correcting unit symbol, being connected to the usual symbol for these elements by a thin line. With this type of presentation, explanatory notes, which may or may not be on the flow sheet, are essential.



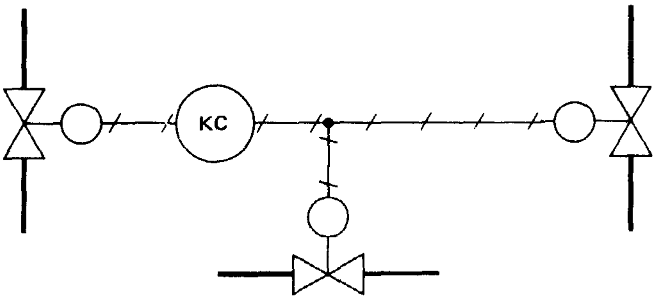
6.11 Programme control

Flow rate recorder-controller whose set value is automatically adjusted to a predetermined programme in time.



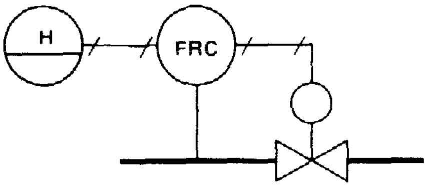
6.12 Time-cycle operation

Three valves automatically actuated according to a predetermined programme in time, two valves being actuated simultaneously.

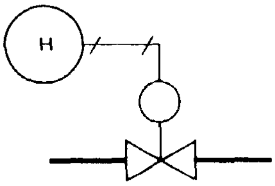


6.13 Hand operation

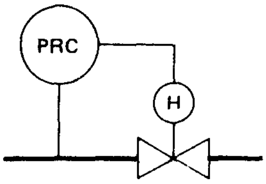
6.13.1 Remote adjustment of the set value of a controller.



6.13.2 Local (indirect) adjustment of a correcting unit.

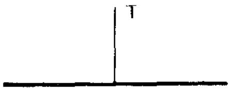


6.13.3 Automatic actuating element with integral manual actuating element.



6.14 Identification of points of measurement only

A point in the plant where provision is made for measurement (for example, of temperature) but to which no instrument is permanently attached.



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